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Lin et al.

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(54) **ANTI-TAMPER DEVICE**

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H05K 5/00 (2006.01)
H05K 5/02 (2006.01)

(52) **U.S. Cl.**
CPC ***H05K 5/0208*** (2013.01); ***H05K 5/0013*** (2013.01); ***H05K 5/0047*** (2013.01)

(58) **Field of Classification Search**
USPC 361/752, 748, 736; 257/678
See application file for complete search history.

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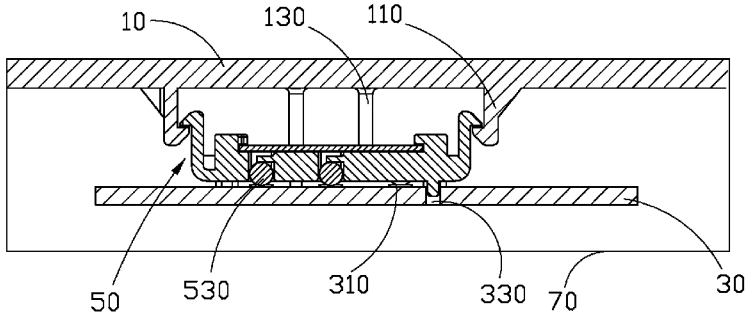
(57) **ABSTRACT**

An anti-tamper device for preventing data from being tampered with by an unauthorized person includes a top cover, a bottom cover, a printed circuit board (PCB), and a signal connector. The bottom cover is assembled to the top cover. The PCB has a plurality of terminal couplers. The signal connector is fastened to the top cover, and the signal connector defines a plurality of terminal grooves. At least one of the terminal grooves receives a terminal. When the terminals are electrically connected to the terminal couplers, a first relation signal is generated to enable the anti-tamper device. When the terminals are not connected to the corresponding terminal couplers, a second relation signal different from the first relation signal is generated by the PCB to make the anti-tamper device unable to work.

16 Claims, 6 Drawing Sheets



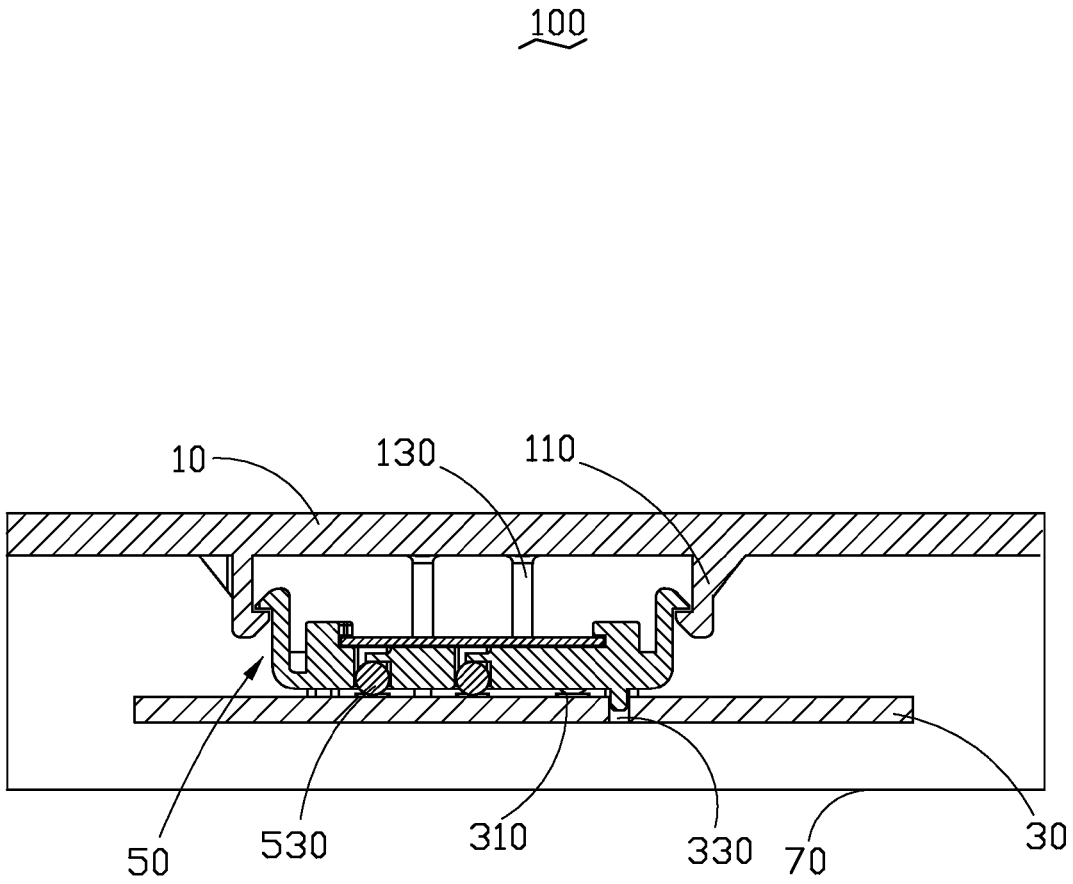


FIG. 1

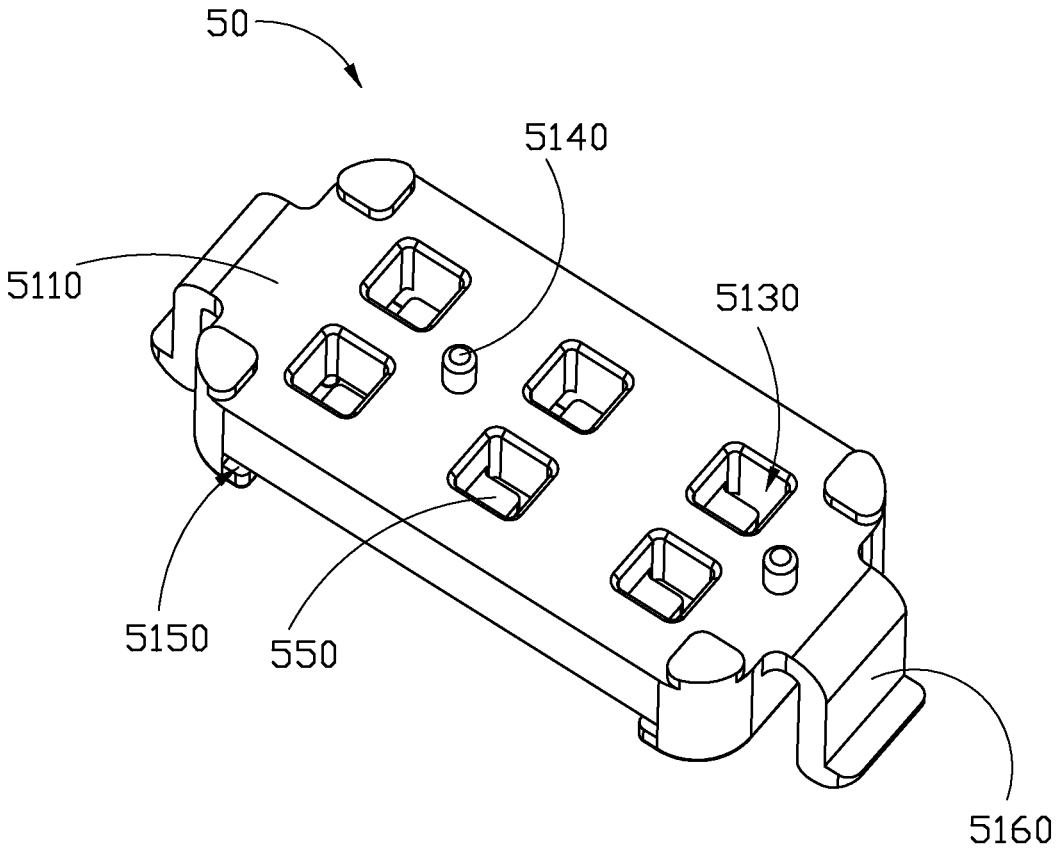


FIG. 2

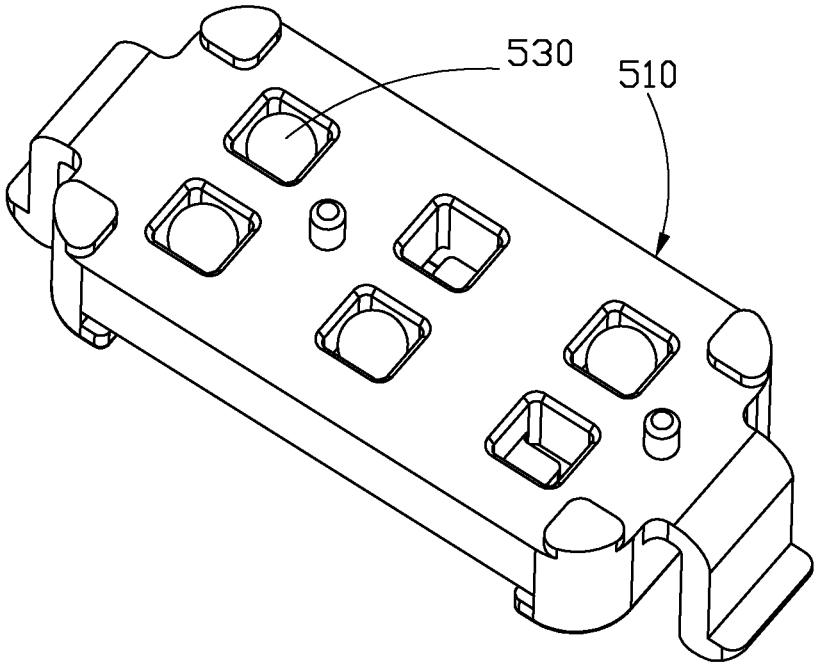


FIG. 3

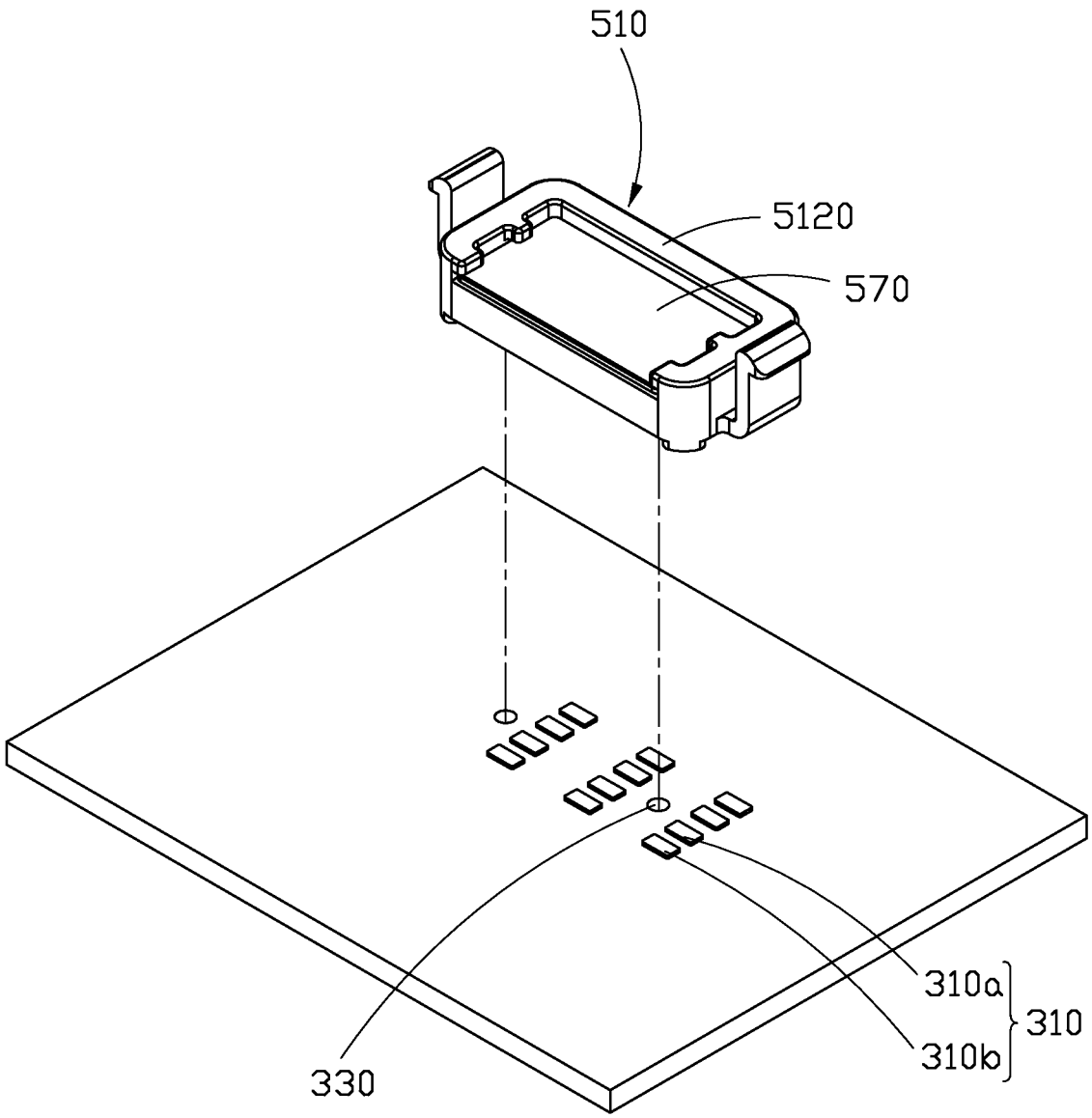


FIG. 4

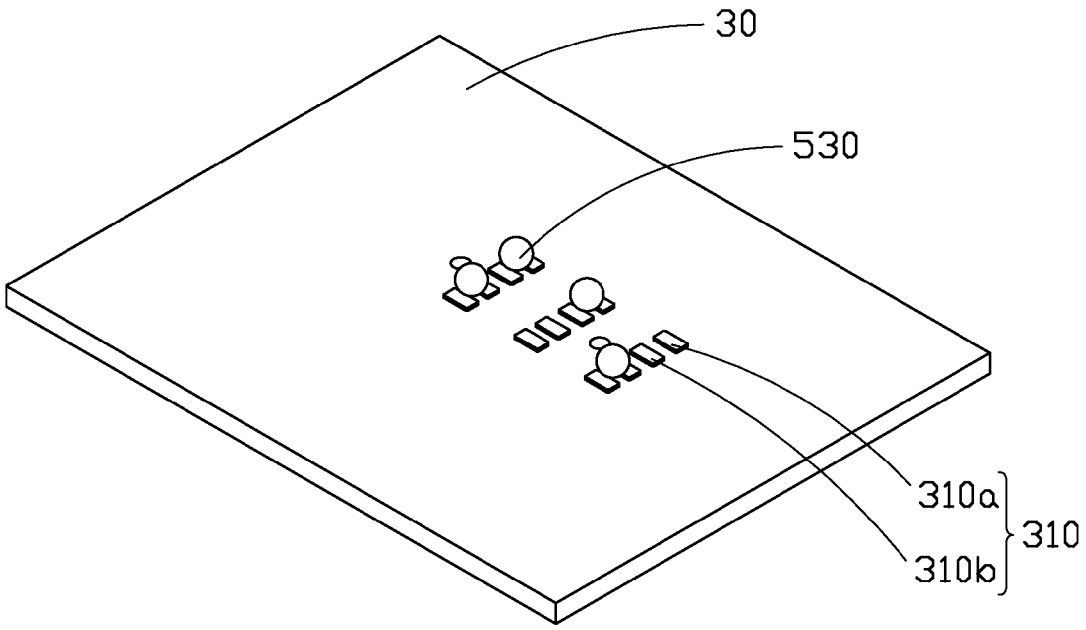


FIG. 5

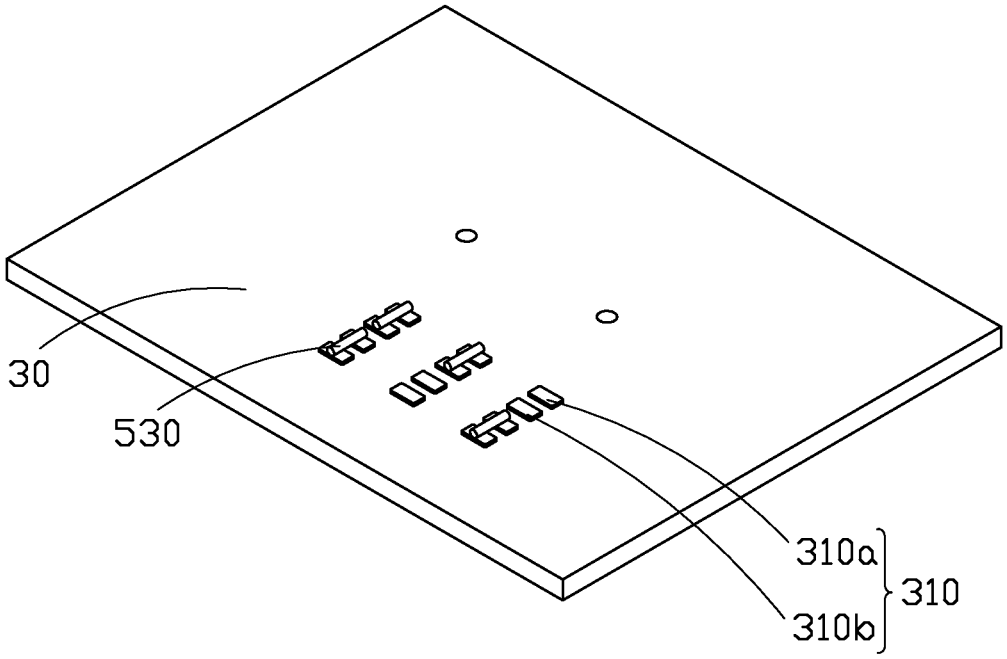


FIG. 6

ANTI-TAMPER DEVICE

FIELD

The subject matter relates to data protection technologies, and more particularly to an anti-tamper device.

BACKGROUND

Electronic devices usually store confidential data such as account information in components of the electronic devices. In order to prevent an unauthorized person from accessing the components storing the confidential data, the components are located in a sealed housing. However, the housing of the electronic device must be able to be easily opened in order for a service repairman or technician to repair or replace any components when maintenance is required.

BRIEF DESCRIPTION OF THE DRAWINGS

Implementations of the present technology will now be described, by way of example only, with reference to the attached figures.

FIG. **1** is a cross-sectional view of an anti-tamper device including a printed circuit board (PCB) and a signal connector.

FIG. **2** is an isometric view of the signal connector of FIG. **1**.

FIG. **3** is an isometric view of the signal connector with a plurality of terminals.

FIG. **4** is an isometric view showing the signal connector separating from the PCB.

FIG. **5** is an isometric view showing the PCB with the terminals in a first embodiment.

FIG. **6** is an isometric view showing the PCB with the terminals in a second embodiment.

DETAILED DESCRIPTION

It will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have been repeated among the different figures to indicate corresponding or analogous elements. In addition, numerous specific details are set forth in order to provide a thorough understanding of the embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein can be practiced without these specific details. In other instances, methods, procedures, and components have not been described in detail so as not to obscure the related relevant feature being described. Also, the description is not to be considered as limiting the scope of the embodiments described herein. The drawings are not necessarily to scale and the proportions of certain parts may be exaggerated to better illustrate details and features of the present disclosure.

The term "comprising," when utilized, means "including, but not necessarily limited to"; it specifically indicates open-ended inclusion or membership in the so-described combination, group, series and the like.

The present disclosure is described in relation to an anti-tamper device **100**.

FIG. **1** illustrates a cross-sectional view of an anti-tamper device **100** for securing data. The anti-tamper device **100** can be a set-top box, router, a computer, or a portable device. The anti-tamper device **100** includes a top cover **10**, a bottom cover **70**, a printed circuit board (PCB) **30**, and a signal connector **50**. The top cover **10** is detachably coupled to the bottom cover **70** defining a receiving space for receiving the PCB **30** and the signal connector **50**. The signal connector **50** is coupled to the top cover **10** and located between the top cover **10** and the PCB **30**. When the top cover **10** is coupled to the bottom cover **70**, the signal connector **50** makes contact with the PCB **30**. When the top cover **10** is disengaged from the bottom cover **70**, the signal connector **50** is separated from the PCB **30** synchronously.

FIGS. **2**, **3** and **4** illustrate that a bulge **130** and a pair of first clamps **110** both protrude from a surface of the top cover **10** facing the PCB **30** towards the bottom cover **70**. The signal connector **50** includes a supporting base **510**, a plurality of terminals **530** received in the supporting base **510**, and a plurality of elastic pieces **550**. The supporting base **510** is a rectangular board. The supporting base **510** includes a first surface **5110** and a second surface **5120** opposite to the first surface **5110**, the first surface **5110** faces the PCB **30**, and the second surface **5120** faces the top cover **10**. A pair of second clamps **5160** protrudes from the supporting base **510** and is located at opposite ends of the supporting base **510**. The supporting base **510** further defines a plurality of terminal grooves **5130** and a receiving groove **5150**. The terminal grooves **5130** are defined in the first surface **5110**. In at least one embodiment, the terminal grooves **5130** number six. Each of the elastic pieces **550** is located in a corresponding one of the terminal grooves **530**. In at least one embodiment, each of the terminal grooves **5130** runs through the first surface **5110** and the second surface **5120**. A locating protrusion **5140** protrudes from the first surface **5110** towards the PCB **30**. The receiving groove **5150** is defined in the second surface **5120**. In at least one embodiment, the receiving groove **5150** is communicating with the terminal grooves **5130**. In other embodiments, the receiving groove **5150** is not communicating with the terminal grooves **5130**. A magnet **570** is detachably received in the receiving groove **5150**. The terminals **530** are received in the terminal grooves **5130** correspondingly. The terminals **530** received in the terminal grooves **5130** are attracted by the magnet **570** preventing the terminals **530** from falling out of the corresponding terminal groove **5130**. In at least one embodiment, the terminals **530** are metal balls; a diameter of each terminal groove **5130** is larger than a diameter of the terminal **530**, which allows the terminal **530** to move freely in the terminal groove **5130**. In other embodiments, the terminals **530** can be metal columns. In at least one embodiment, the terminals **530** number four. In other embodiments, the number of the terminals **530** can be more or less than four, but cannot exceed the number of the terminal grooves **5130**.

FIGS. **5** and **6** illustrate that a plurality of terminal couplers **310** are located on the PCB **30** corresponding respectively to the plurality of terminal grooves **5130**. A locating hole **330** is defined in the PCB **30** corresponding to the locating protrusion **5140**. In at least one embodiment, each of the terminal couplers **310** includes two metal pads **310***a*, **310***b*, and the two metal pads **310***a*, **310***b* are spaced from each other.

In assembly, first, the four terminals **530** are placed in the four of the six terminal grooves **5130**; the four terminals **530** are attached to and held in the receiving groove **5150** by the magnet **570**. Second, the locating protrusion **5140** is inserted into the locating hole **330** coupling with and preventing the signal connector **50** from moving relative to the PCB **30**. The terminals **530** are pressed by the corresponding elastic pieces **550** to electrically couple to the corresponding terminal couplers **310**. Third, the magnet **570** is detached from the receiving groove **5150**. Fourth, the top cover **10** is coupled to the bottom cover **70**, the first clamps **110** are engaged with the second clamps **5160** to fix the signal connector **50** to the top

cover **10**, and the bulge **130** blocks the second surface **5120** to limit a movement of the signal connector **50**, at this time, the anti-tamper device **100** has been assembled. When the anti-tamper device is powered on for the first time after assembly, a first relative signal is generated by the PCB **30** to enable the anti-tamper device **100**. The first relative signal indicates which terminal couplers **310** are electrically connected to the terminals, an original location relationship of the terminals **530** and the terminal grooves **5130**. A memory device (not shown) on the PCB **30** is utilized to store the first relative signal.

When the top cover **10** is disengaged from the bottom cover **70** by an unauthorized person, the signal connector **50** is separated from the PCB **30** by the engagement of the first clamps **110** and the second clamps **5160**, which cause the four terminals **530** to drop from the corresponding terminal grooves **5130** and disconnect from the terminal couplers **310**. Because the terminals **530** drop from the terminal grooves **5130**, the unauthorized person cannot put the terminals **530** back in the corresponding terminal grooves **5130**. As a result, when the anti-tamper device **100** is assembled again as described above, a current location relationship between the terminals **530** and the terminal grooves **5130** will be different from the original location relationship described above. Furthermore, when the anti-tamper device **100** is powered on again after the reassembly, a second relation signal is generated for indicating the current location relationship between the terminals **530** and the terminal grooves **5130**. The PCB **30** is utilized to compare the first relation signal to the second relation signal, when the second relation signal is different from the first relation signal; the PCB **30** disables the anti-tamper device **100**.

With the anti-tamper device **100** described above, when an unauthorized person tries to manipulate data in the system by detaching the top cover **10** from the bottom cover **70**, the terminals **530** drop from the corresponding terminal grooves **5130** which makes the unauthorized person unable to decide which terminal coupler **310** is electrically connected by the terminal **530**. When the signal connector **50** is assembled to the PCB **30** and the terminals **530** are electrically connected to the terminal coupler **310** again, a second relation signal failing to conform to the first relation signal is generated to prevent the unauthorized person from operating the anti-tamper device **100**.

Many details are often found in the art such as the other features of a shielding plate. Therefore, many such details are neither shown nor described. Even though numerous characteristics and advantages of the present technology have been set forth in the foregoing description, together with details of the structure and function of the present disclosure, the disclosure is illustrative only, and changes may be made in the detail, especially in matters of shape, size, and arrangement of the parts within the principles of the present disclosure, up to and including the full extent established by the broad general meaning of the terms used in the claims. It will therefore be appreciated that the embodiments described above may be modified within the scope of the claims.

What is claimed is:

1. An anti-tamper device comprising:

a top cover;

a bottom cover detachably connected to the top cover;

a printed circuit board (PCB) fixed on the bottom cover, the PCB having a plurality of terminal couplers;

a signal connector fastened to the top cover and located between the PCB and the top cover, the signal connector defining a plurality of terminal grooves; and

a plurality of terminals, a number of the terminals being less than or equal to a number of the terminal grooves, the terminals being received in the terminal grooves correspondingly and electrically coupled to the terminal couplers correspondingly;

wherein when the top cover is disconnected from the bottom cover, the signal connector is separated from the PCB, and the terminals drop from the terminal grooves, when the top cover is connected to the bottom cover again and the terminals are not received in the terminal grooves correspondingly, the terminals are not electrically connected to the terminal couplers correspondingly and the anti-tamper device is unable to work.

2. The anti-tamper device of claim **1**, wherein when the terminals are electrically connected to the corresponding terminal couplers, a first relative signal is generated by the PCB to enable the anti-tamper device; when the terminals are not connected to the corresponding terminal couplers, a second relative signal different from the first relative signal is generated by the PCB to make the anti-tamper device be out of work.

3. An anti-tamper device comprising: a top cover; a bottom cover detachably connected to the top cover; a printed circuit board (PCB) fixed on the bottom cover, the PCB having a plurality of terminal couplers; a signal connector fastened to the top cover and located between the PCB and the top cover, the signal connector defining a plurality of terminal grooves; and a plurality of terminals, a number of the terminals being less than or equal to a number of the terminal grooves, the terminals being received in the terminal grooves correspondingly and electrically coupled to the terminal couplers correspondingly; wherein when the top cover is disconnected from the bottom cover, the signal connector is separated from the PCB, and the terminals drop from the terminal grooves, when the top cover is connected to the bottom cover again and the terminals are not received in the terminal grooves correspondingly, the terminals are not electrically connected to the terminal couplers correspondingly and the anti-tamper device is unable to work, wherein the signal connector comprises a supporting base, the plurality of terminal grooves are defined in a first surface of the supporting base facing the PCB, a receiving groove is defined in a second surface of the supporting base opposite to the first surface, a magnet is located in the receiving grooves to attract the terminals received in the corresponding terminal grooves when the signal connector is coupled to the PCB, and the magnet is taken out of the receiving groove before the top cover is connected to the bottom cover.

4. The anti-tamper device of claim **1**, wherein a number of the terminals received in the corresponding terminal grooves is less than a number of the terminal grooves.

5. The anti-tamper device of claim **1**, wherein a pair of first clamps projects from the top cover towards the PCB, a pair of second clamps projects from the second surface of the supporting base towards the top cover, the second clamps are engaged with the first clamps to fix the signal connector to the top cover.

6. The anti-tamper device of claim **1**, wherein at least one locating protrusion is located on the first surface, at lease one locating hole is defined in the PCB corresponding to the locating protrusion, and the locating protrusion is inserted into the locating hole to make the signal connector be coupled to the PCB.

7. The anti-tamper device of claim **1**, wherein an elastic piece is located in each of the terminal grooves and between the terminal and the signal connector, and the elastic piece is

compressed by the corresponding terminal and the signal connector when the top cover is connected to the bottom cover.

8. The anti-tamper device of claim **1**, wherein each of the terminals is a metal ball which is movably received in the terminal groove.

9. The anti-tamper device of claim **1**, wherein a number of terminal couplers is the same with a number of terminal grooves, each of the terminal couplers comprises two apart metal pads, and each of the terminals is electrically connected with the two metal pads.

10. An anti-tamper device comprising: a top cover; a bottom cover detachably assembled to the top cover; a printed circuit board (PCB) received between the bottom cover and the top cover, the PCB having a plurality of terminal couplers; and a signal connector fastened to the top cover and located between the PCB and the top cover, the signal connector defined a plurality of terminal grooves, a first terminal groove of the terminal grooves receiving a terminal, and a corresponding one of the terminal couplers being electrically connected to the terminal; wherein when the top cover is disassembled from the bottom cover, the signal connector is separated from the PCB, and the terminal drops from the first terminal groove; when the top cover is assembled to bottom cover again and the dropped terminal is received in a second terminal groove of the terminal grooves, the corresponding terminal coupler is disconnected from the coupler, the anti-tamper device is out of work, wherein the signal connector comprises a supporting base, the plurality of terminal grooves are defined in a first surface of the supporting base facing the PCB, a receiving groove is defined in a second surface of the supporting base opposite to the first surface, a magnet is located in the receiving grooves to attract the terminals received in the corresponding terminal grooves when the signal connector is coupled to the PCB, and the magnet is taken out of the receiving groove before the top cover is connected to the bottom cover.

11. The anti-tamper device of claim **10**, wherein the terminal grooves correspond to the terminal couplers, respectively, when the terminals are received in the terminal grooves, the terminals are electrically connected to the terminal couplers corresponding the terminal grooves.

12. The anti-tamper device of claim **10**, wherein a pair of first clamps projects from the top cover towards the PCB, a pair of second clamps projects from the second surface of the supporting base towards the top cover, the second clamps are engaged with the first clamps to fix the signal connector to the top cover.

13. The anti-tamper device of claim **12**, wherein at least one locating protrusion is located on the first surface, at lease one locating hole is defined in the PCB corresponding to the locating protrusion, and the locating protrusion is inserted into the locating hole to make the signal connector be coupled to the PCB.

14. The anti-tamper device of claim **10**, wherein an elastic piece is located in each of the terminal grooves and between the terminal and the signal connector, and the elastic piece is compressed by the corresponding terminal and the signal connector when the top cover is connected to the bottom cover.

15. The anti-tamper device of claim **10**, wherein each of the terminals is a metal ball which is movably received in the terminal groove.

16. The anti-tamper device of claim **10**, wherein a number of terminal couplers is the same with a number of terminal grooves, each of the terminal couplers comprises two apart metal pads, and each of the terminals is electrically connected with the two metal pads.

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